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A R C H I V E S O F M E T A L L U R G Y A N D M A T E R I A L S

Volume 58 2013 Issue 3

DOI: 10.2478/amm-2013-0105

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THE LEAN MANUFACTURING TOOLS IN POLISH FOUNDRIES

STAN WYKORZYSTANIA NARZĘDZI LEAN MANUFACTURING W POLSKICH ODLEWNIACH

The concept of Lean Manufacturing (or Lean Production) is widely present in the quality management systems of the best factories. Foundry plants in Poland have continuously been implementing modern management tools; however, the experiences of the authors show that the usage of lean tools is at a lower level in domestic foundries than in similar plants abroad. This was the reason why a survey was prepared and over 300 foundry plants were questioned regarding the application of Lean Manufacturing tools. The questions (20 in total) asked if and what tools are implemented in the plant and what benefits have been achieved, or why lean tools have not been implemented in a particular plant. The answers were thoroughly analysed and the results show that, among others, only 29% of all foundries use lean tools, and the main reason why most of them do not is that these tools are not understood well enough.

Keywords: Lean Manufacturing, Lean Production, Quality Management

Koncepcja Lean Manufacturing (lub Lean Production) obecna jest szeroko w systemach zarządzania wiodących zakładów przemysłowych. W odlewnictwie, w tym polskim, również widoczny jest stały postęp we wdrażaniu nowoczesnych narzędzi zarządzania. Jednak doświadczenia autorów wskazują, że w aspekcie zastosowania narzędzi lean, polskie odlewnie odstają jednak od zagranicznych. Te spostrzeżenia były powodem podjęcia badań, ankietowych skierowanych do krajowych odlewni (ponad 300). Pytania (łącznie 20) dotyczyły głównie zagadnień, czy i jakie narzędzia lean są wykorzystywane w zakładzie, jakie są korzyści z ich stosowania lub też dlaczego takich narzędzi nie wdrożono. Odpowiedzi zostały starannie przeanalizowane a wyniki wskazują między innymi, że zaledwie 29% odlewni stosuje jakiekolwiek narzędzia lean a najczęstszym powodem ich niestosowania jest niewystarczające zrozumienie.

1. Introduction

The highest casting quality is a matter of utmost importance for any foundry plant. This quality can be achieved thanks to the best available technology and its continuous improvement, e.g. by looking for the best charging materials [1]. Another method is to develop certain complex materials or systems, such as bimetallic layers on castings as in [2]. However, the best production practice is a total quality management approach in which a very important role is played by modern quality tools grouped in the so-called Lean Manufacturing. Lean Manufacturing (or Lean Production) can be defined as a philosophy, strategy or concept that depends on a set of practices/tools that are implemented to minimise waste (e.g. extra inventories, scraps, reworks, etc.) in order to improve company performance [3,4]. Lean production originates from the Toyota Production System. The focus of this complex approach is on cost reduction by eliminating non-value-added activities, using simple tools such as 5S [5], cellular manufacturing, or is more complex such as JIT or total productive maintenance, production smoothing, setup reduction, etc. [6]. Just in Time (JIT) manufacturing, which was implemented in Toyota in the 1960s as one of the first strategies that was later labeled lean manufacturing, aims to eliminate waste and to improve production by using a continuous improvement approach. Lean production enables the integration of various tools in the production system and supply chain to reduce costs, improve quality and decrease lead time and equipment downtime [7]. To make the process of lean implementation easier and its effectiveness better, many modern tools were developed especially with the use of statistical methods (SPC – Statistical Process Control) and computer tools [7-9]. A foundry plant, which is very often a medium- or large-sized company, should also be a place of lean implementation. When the state of the art is analysed in this field it is visible that the usage of lean tools is quite common in foundries abroad, yet Polish foundries are reluctant to implement them. That is why the authors sent researches to find out what the level of lean tool implementation is in domestic foundries. The article presents an analysis of the answers provided to a 20-question survey regarding lean issues. Statistical analysis was performed along with a qualitative assessment of the open-ended questions. The results were analysed against a foundry profile background and conclusions were drawn at the end.

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2. Research methodology

Both the literature review and the authors' own experiences and knowledge show that no complex study on the lean strategy and utilisation of lean tools inside the Polish foundry industry has been done. Some research studies were done in particular fields of quality management [10,11] or there are descriptions of selected lean tools [12,13], but there is no study showing the level of "lean thinking" of the Polish foundry industry. Obviously, both the level of quality management and produced castings are getting better year by year, which can be seen in [14] but, again, the scientific approach to the lean strategy has been minor. Therefore, the purpose of this research was to find out how significant usage of lean tools is in domestic foundries. A survey questionnaire consisting of 20 questions was prepared. It consisted of 16 closed questions in which the respondent had to choose one of the given answers and in 4 open-ended questions in which some personal comments could be made. The questions were focused on the foundry plant itself: on its size, profile (cast iron, cast steel or non-ferrous), number of employees (including the percentage of engineering staff) and the plant's situation after Poland's accession to the EU. However, the most important part of the survey covers issues concerning the particular lean tools that are or are not used in a company. In the article an analysis of the answers given to chosen questions was shown along with the comments and a short overview of the answers to the open-ended questions. Over 300 questionnaires were delivered to the foundries, but unfortunately many questionnaires were left unanswered. In total, almost 100 forms were received but, again, some of them stated that the given foundry no longer existed, etc. However, the database obtained was large enough to develop the analysis, and the results, in the authors' opinion, are quite representative.

3. Results analysis

After the survey the answers were included into datasheet and the analysis was conducted. The selected results are presented in this section, giving good outlook of the lean tools issue in Polish foundries. The subsections are named analogically to the questions and the graphs showing the answers distributions are included, too. The short analysis concludes the particular topic and the last section finishes the article with general conclusions and opinions about the future of lean implementation in Polish foundry industry.

3.1. Has the Lean Manufacturing strategy been implemented in your foundry?

Lean principles have been in use for over forty years, so one can suppose that the percentage of plants using it would be high, independently of the branch, but this is not true for the Polish foundry industry. The distribution of answers given for this question is presented in Fig. 1. It is quite surprising that only 29% of the foundries have implemented any of the lean tools.

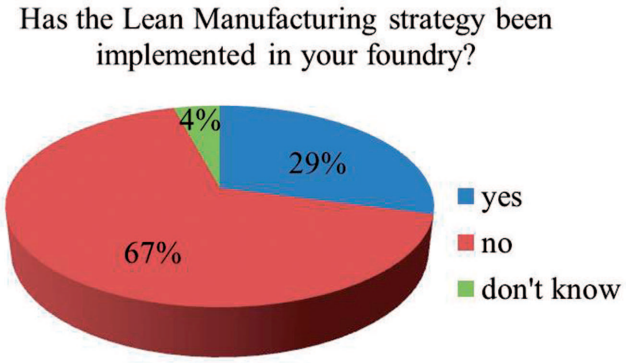

Fig. 1. Implementation of Lean Manufacturing strategy in foundries

However, an analysis of this question along with questions regarding the size and income of the plant shows that most of the largest companies have already implemented the lean strategy. Moreover, companies with a higher percentage of engineers are more eager to implement the lean strategy. This is similar to other industry branches where the largest companies are the leading ones in lean thinking.

3.2. Which Lean Manufacturing tools have been implemented in your foundry?

For this question it was possible to select multiple answers from a list of the most common lean tools, such as Kaizen (Japanese for "improvement" or "change for the better"), Kanban (Japanese for "signboard" or "billboard", which is a scheduling system for just-in-time JIT production), 5S (the name of a workplace organisation method based on five Japanese words: seiri, seiton, seiso, seiketsu, and shitsuke, translated into English as sort, set in order, shine, standardise and sustain), Benchmarking, TPM (Total Productive Maintenance), and SMED (Single Minute Exchange of Die). The results are shown in Fig. 2, and it is visible that the 5S system is the most popular. It is also the simplest and often a no-cost approach.

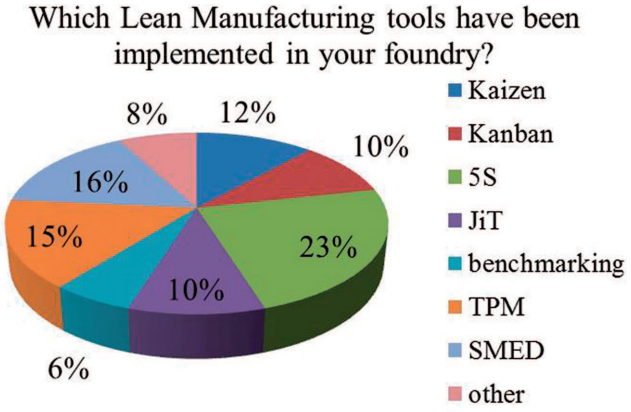

Fig. 2. Use of the particular lean tools

The SMED method is quite popular (14%) and for the group of automatic (flask and non-flask lines) or pressure die foundries it is one of the most important and beneficial lean tools. In such foundries the tool (pressure dies, pattern plates, etc.) optimal exchange time is a truly important matter that directly influences company productivity. The TPM method (14%) is an approach that can be interesting for all

medium-sized or large foundries with a high level of mechanisation, automation and robotics when continuously and properly working equipment is crucial for the manufacturing process.

3.3. How long have the Lean Manufacturing tools been used in your foundry?

The answers given for this question show that lean tools are still quite a new concept in Polish foundries and that only 7% of the foundries that do use them have been doing so for longer than 5 years. All of the foundries from this group are large companies employing automatic foundry lines and mass production. A graphical presentation of the results is shown in Fig. 3.

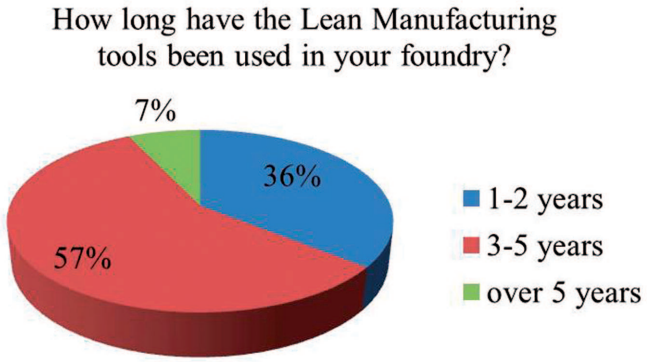

Fig. 3. Time period of lean tools usage

3.4. Has Lean implementation been beneficial for your foundry?

The answers here are quite surprising as only 71% of the respondents confirmed that there were benefits for the foundry after lean tools had been implemented (see Fig. 4). Of course this pessimistic result may only be the subjective opinion of the person who answered the survey. However, the questionnaire was directed at foundry management and executives, so their approach should be more enthusiastic, in the authors' opinion, and they should spread positive thinking from the top to the bottom inside the company.

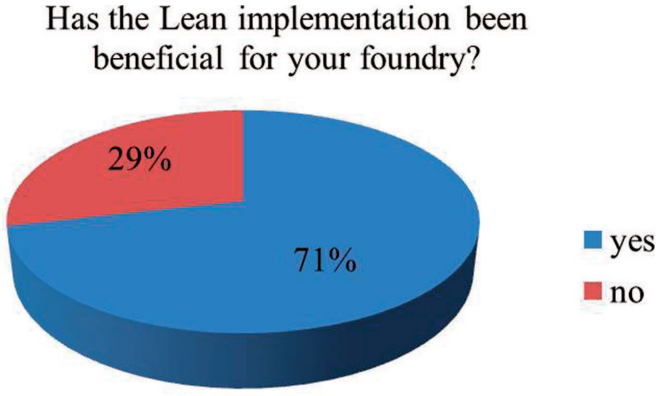

Fig. 4. Statement about the benefits of the lean strategy

3.5. Why has your foundry not implemented Lean Manufacturing tools?

The main reason why Polish foundries are not implementing lean tools seems to be a lack of knowledge (64% of the answers were marked "not well known"). This is quite surprising because the lean strategy has been promoted for several decades and potentially every engineer should know the methods and understand the benefits of this approach. Obviously, lean thinking is dedicated mostly to bigger companies [15], but many tools such as 5S, SMED or JIT can also be implemented in smaller plants. The next reason (10% of the answers) is the cost of the implementation process, and of course one can agree with this but, again, some tools (mostly 5S) can be no-cost or low-cost activities. The distribution of answers is shown in Fig. 5.

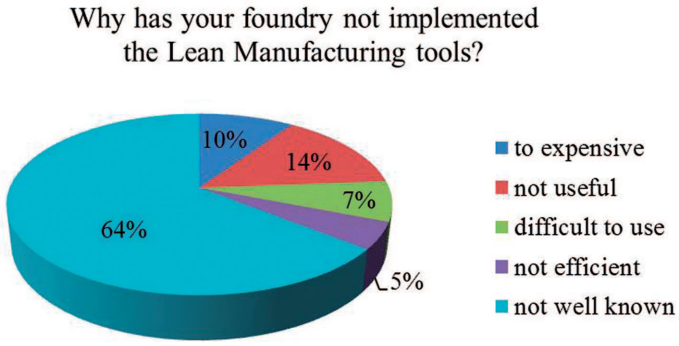

Fig. 5. Reasons to not implement lean tools

3.6. Is your foundry going to implement Lean tools in the future?

Changes in management styles have been one of the most dynamic processes in the Polish economy in the last decade, and this is also true for the foundry industry. Many foundry plants, especially when they become a part of international companies, must start the "lean thinking" approach because it is a part of the whole company's market strategy. However, the answer to the given question is mostly "no" (64% of the total answers), which corresponds well with the previous question – it is rather impossible to use things one does not know. A graph with the results is shown in Fig. 6.

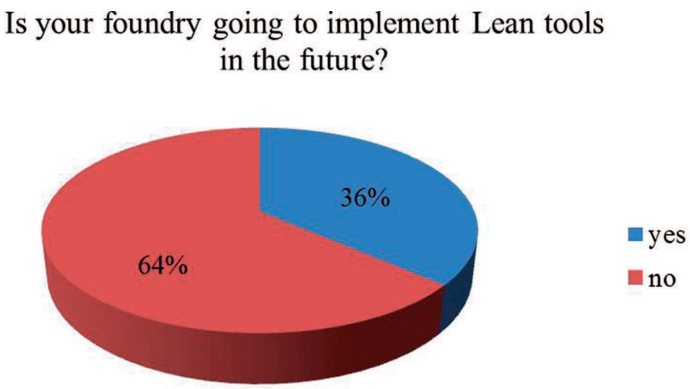

Fig. 6. The future of lean tools in foundries

3.7. Open-ended questions overview

In some questions the respondents were asked to include their own comments. They could explain what other quality management tools they were using in their plants instead of the lean manufacturing tools. The most common answer was that of a "company internal quality management system" or a similar system. Such an approach is typical of smaller foundries, where more complicated or more bureaucratic systems are recognised as non-beneficial or non-cost-effective. However, many small foundries do use lean tools (mostly 5S) but are not aware of this. Another question concerned the benefits from lean tools in particular foundries. The answers were focused on organisation of a better working environment, better quality, and better utilisation of resources, however, developing the company image was also important. This shows that foundries which have implemented the lean strategy are convinced about the wide range of benefits this managerial approach can provide.

4. Conclusions

The article presents the issue of lean manufacturing tools in the Polish foundry industry. The survey was carried out and many foundries were analysed. The results were presented in the form of graphs and some analysis was performed. The following conclusions have been drawn:

- although lean tools seem to be well known and widely used, the foundries generally are not much aware of the long-term benefits of such an approach,
- the largest problem with lean thinking is that foundry personnel (including engineering staff) are not well educated in this field and have only general knowledge in this area, which is not enough to drive changes inside the plant,
- the cost of lean implementation is also important, so cost-effective and inexpensive tools (mostly 5S) should be widely promoted as the first sign of the lean strategy, thus making it more friendly and convincing for potential users,
- pressure should be put on smaller foundries, which are often less open and willing to introduce management changes, in order to convince their owners and managers that some lean tools can be adjusted to a plant of any size and specification,
- not many foundries plan to implement lean tools in the nearest future, so activity to change this situation should be quick and education in this area must be more effective.

Acknowledgements

This research project was financed from support funds for science during 2010-2014.

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This article was first presented at the VI International Conference "DEVELOPMENT TRENDS IN MECHANIZATION OF FOUNDRY PROCESSES", Inwałd, 5-7.09.2013

Received: 20 January 2013.